

Supplementary Figure 1. Increased absolute volume of the superior colliculus in male *Fmr1- Δ exon 8* rats compared to WT littermates. (A) Heatmap of effect sizes of genotype on significant differences in absolute volume in T2 images where an increase in purple denotes an increase in *Fmr1- Δ exon 8* compared to WT rats and pink denotes a decrease. (B) Boxplot of the significantly increased volume of the superior colliculus, (WT: N = 15; *Fmr1- Δ exon 8*: N = 14).

Supplementary Figure 2. Volumes of brain regions of male and female *Fmr1- Δ exon 8* and WT littermates. (A) Heatmap of *p*-values from ANOVA and LM tests for the effect of sex on volume in T2 images where an increase in red denotes increased Bonferroni-corrected significance. (B) Boxplot of the volume of the whole brain, (N = 15/group), ****p* < 0.001.

Supplementary Figure 3. Example coronal slices of the regions that were altered in *Fmr1- Δ exon 8* rats, using the semi-manual segmentation and Waxholm Space Atlas.

Supplementary Figure 4. Voxel-wise analysis of diffusion indices in male and female *Fmr1- Δ exon 8* and WT littermates. Maps of the t-statistic across the brain, showing the voxels that are increased or decreased in mean intensity in the *Fmr1- Δ exon 8* rats compared to WT and boxplots of group means for (A) FA, (B) MD, and (C) RD where the significance of the pair-wise comparisons from the Tukey HSD or LM is reported, (N = 15/group), ****p* < 0.001.